CLAIMS:

1. An electromagnetic actuator comprising:

a cylinder;

a stationary core arranged in the cylinder;

a movable core arranged in the cylinder; and

a coil located about the cylinder, wherein the movable core moves in the cylinder in accordance with an electromagnetic force, which is generated between the stationary core and the movable core based on the current supply to the coil;

wherein the cylinder includes a first cylindrical member made of nonmagnetic material, the first cylindrical member surrounding the stationary core and the movable core, and a second cylindrical member made of magnetic material,

wherein a part of the first cylindrical member in the vicinity of the movable core is made thin to form a small diameter portion, and wherein the small diameter portion is fitted to the second cylindrical member.

2. The electromagnetic actuator according to claim 1, wherein the cylinder is cup-shaped, and the movable core and the stationary core are arranged in this order from the bottom portion of the cylinder, and wherein the small diameter portion is formed in the vicinity of the bottom portion of the first cylindrical member of the cylinder.

3. The electromagnetic actuator according to claim 2, wherein the first cylindrical member is cup-shaped.

4. The electromagnetic actuator according to claim 2, wherein the second cylindrical member is cup-shaped.

5. The electromagnetic actuator according to claim 1, wherein the first cylindrical member includes a large diameter portion, which is adjacent to the small diameter

portion, and a connecting portion, which connects the large diameter portion and the small diameter portion, and wherein the connecting portion forms a step.

6. The electromagnetic actuator according to claim 5, wherein the first cylindrical member further includes a positioning portion for determining the axial position of the first cylindrical member with respect to the second cylindrical member, and wherein, when the position of first cylindrical member is determined, a space is formed on the outer surface of the cylinder between the first cylindrical member and the second cylindrical member.

7. The electromagnetic actuator according to claim 1, wherein the movable range of the movable core along the inner surface of the cylinder corresponds to the inner surface of the first cylindrical member.

8. An electromagnetic actuator comprising:

a cylinder;

a stationary core fixed at the upper inner surface of the cylinder;

a movable core arranged at the lower portion of the cylinder; and

a coil located about the cylinder, wherein the movable core moves in the cylinder in accordance with an electromagnetic force, which is generated between the stationary core and the movable core based on the current supply to the coil;

wherein the cylinder includes a first cylindrical member made of nonmagnetic material, the first cylindrical member surrounding the stationary core and the movable core, and a second cylindrical member made of magnetic material,

wherein a part of the first cylindrical member in the vicinity of the movable core is made thin to form a small diameter portion, and wherein the small diameter portion is

fitted to the second cylindrical member.

9. The electromagnetic actuator according to claim 8, wherein the cylinder is cup-shaped, wherein the small diameter portion is formed at the bottom portion of the first cylindrical member of the cylinder.

10. The electromagnetic actuator according to claim 9, wherein the first cylindrical member is cup-shaped.

11. The electromagnetic actuator according to claim 9, wherein the second cylindrical member is cup-shaped.

12. The electromagnetic actuator according to claim 8, wherein the first cylindrical member includes a large diameter portion, which is adjacent to the small diameter portion, and a connecting portion, which connects the large diameter portion and the small diameter portion, and wherein the connecting portion forms a step.

13. A control valve comprising:

a cylinder;

a stationary core arranged in the cylinder;

a movable core arranged in the cylinder;

a coil located about the cylinder, wherein the movable core moves in the cylinder in accordance with an electromagnetic force, which is generated between the stationary core and the movable core based on the current supply to the coil, and wherein an electromagnetic actuator is structured by the cylinder, the stationary core, the movable core, and the coil,

wherein the cylinder includes a first cylindrical member made of nonmagnetic material, the first cylindrical member surrounding the stationary core and the movable core, and a second cylindrical member made of magnetic material,

wherein a part of the first cylindrical member in the

vicinity of the movable core is made thin to form a small diameter portion, and wherein the small diameter portion is fitted to the second cylindrical member; and

a valve body, which is connected to and driven by the movable core of the electromagnetic actuator, wherein the valve body adjusts the opening degree of a communication passage, and wherein the valve body adjusts the opening degree of the passage in accordance with the displacement of the movable core.

14. The control valve according to claim 13, wherein the control valve is used for changing the displacement of a variable displacement compressor.

15. The control valve according to claim 14, wherein the variable displacement compressor includes:

a cam plate;

a crank chamber, which accommodates the cam plate;

a suction chamber;

a discharge chamber;

a bleed passage, which communicates the crank chamber with the suction chamber; and

a supply passage, which communicates the discharge chamber with the crank chamber,

wherein the displacement is controlled by adjusting the pressure in the crank chamber, and wherein the pressure in the crank chamber is controlled by adjusting the opening degree of the bleed passage or the supply passage with the valve body.

16. The control valve according to claim 15, wherein the compressor forms a refrigerant circuit together with an external refrigerant circuit, which is connected to the compressor, wherein the compressor includes a pressure sensing member, which detects the pressure at a pressure monitoring point set in the refrigerant circuit and is

displaced in accordance with the pressure fluctuations at the pressure monitoring point,

wherein the pressure sensing member determines the position of the valve body by the cooperation with the electromagnetic actuator, and wherein a reference pressure for determining the position of the valve body is changed by the electromagnetic actuator.

17. The control valve according to claim 15, wherein the pressure monitoring point is one of two pressure monitoring points, which are located at positions along the refrigerant circuit, wherein the pressure sensing member is displaced in accordance with the fluctuations of the pressure difference between the two pressure monitoring points.

18. The control valve according to claim 15, wherein two pressure monitoring points are located in the discharge chamber in the refrigerant circuit.

19. The control valve according to claim 18, wherein the refrigerant used in the refrigerant circuit is carbon dioxide.

20. A cylinder for electromagnetic actuator, wherein the cylinder accommodates a stationary core and a movable core, and the cylinder includes a first cylindrical member formed of nonmagnetic material and a second cylindrical member formed of magnetic material, wherein a part of the first cylindrical member in the vicinity of the movable core is made thin to form a small diameter portion, and wherein the small diameter portion is fitted to the second cylindrical member.

21. A method for manufacturing an electromagnetic actuator having a movable core, a cylinder, stationary core, and a coil, wherein the movable core moves in the cylinder in

accordance with an electromagnetic force, which is generated between the stationary core and the movable core based on the current supply to the coil, which is located about the cylinder, wherein the manufacturing method comprising:

preparing a first cylindrical member formed of nonmagnetic material and a second cylindrical member formed of magnetic material, wherein the first cylindrical material surrounds the stationary core and the movable core;

fitting the first cylindrical member to the second cylindrical member; and

machining the inner surface of the first cylindrical member according to a predetermined design.